



LEM: NUMBER ONE in innovation and production of isolated current and voltage sensors

**6 ranges
60 standard models
or your custom-made model**

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LEM

PIONEERING POWER ELECTRONICS

LEM Modules to measure currents from 50 A to 100 A

(nominal value)

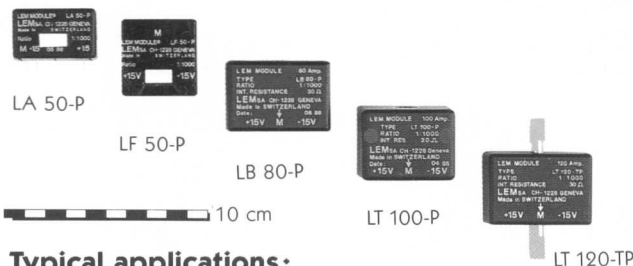
Series: L...-P, L...-TP**

These models are designed for printed circuit board mounting.

Types within the series: LA 50-P, LF 50-P, LT 80-P
LT 100-P, LB*80-P, LB*100-P

General information:

- power supply voltage: + and - 15 V ($\pm 5\%$)
- measuring range: 0 to $\pm 1.5 \times$ nominal current
- analogue nominal output current: 50mA to 100mA
- test voltage: 2-3 kV rms/50 Hz/1 min.
- construction: built into an insulated self-extinguishing plastic case.



Typical applications:

Robotic, industrial motor drives, power supplies, UPS, welding equipment, inverters, choppers, various controls.

*Serie LB: These types of sensors are used for accurate measurement of frequency ranges above 300 kHz, and accurately followed di/dt above 400 A/ μ s (patented system).

**Series L ... -TP: with primary bar.

LEM Modules to measure currents from 100 A to 1000 A

(nominal value)

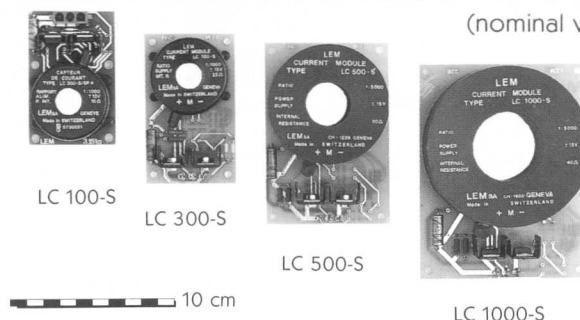
Series: LC... -S

The magnetic assembly is mounted on printed circuit board, which is adaptable to customer order.

Types available in the series: LC 100-S, LC 300-S,
LC- 500-S, LC 1000-S

General information:

- power supply voltage: + and - 15 V ($\pm 5\%$)
- measuring range: 0 to ± 1.5 to $2 \times$ nominal current
- analogue nominal output current: 100 mA to 200 mA
- test voltage: 3 kV rms/50 Hz/1 min.
- construction: printed circuit board mounted.



Typical applications:

Robotic, industrial motor drives, power supplies, UPS, welding equipment, inverters, choppers, various controls.

LEM Modules to measure currents from 100 A to 2000 A

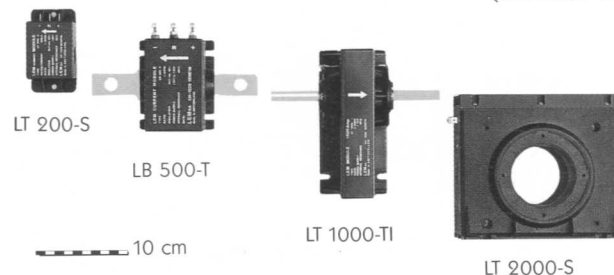
(nominal value)

Series: LT... -S (or T**), LB*... -S (or T**)

Types available in the series: LT 100-S to LT 2000-S
LB 100-S to LB 2000-S

General information:

- power supply voltage: + and - 12 V to 24 V ($\pm 5\%$)
- measuring range: 0 to $\pm 1.5 \times$ nominal current
- analogue nominal output current: 100 mA to 400 mA
- test voltage: 5-6 kV rms/50 Hz/1 min.
- construction: built into an insulated self-extinguishing plastic case.



Typical applications:

Robotic, industrial motor drives, power supplies, UPS, welding equipment inverters, choppers, various controls.

*Series LB: These types of sensors are used for accurate measurement of frequency ranges above 300 kHz, and accurately followed di/dt above 400 A/ μ s (patented system).

**Series L ... -T: with primary bar.

rd Ranges of LEM M

LEM Modules to measure currents from 200 A to 5000 A

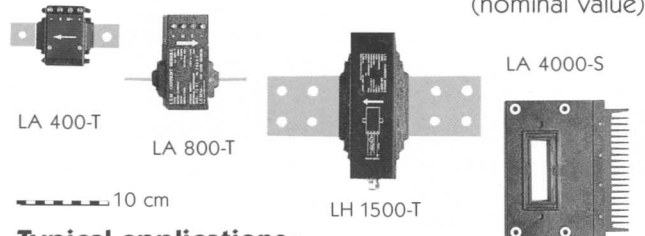
Series: LA ...S (or T**), LH* ...S (or T**)

Types available in the series:

LA 200-S to LA 4000-S, LA 5000-T
LH 200-S to LH 4000-S, LH 5000-T

General information:

- power supply voltage: + and – 15 V to 24 V ($\pm 10\%$)
- measuring range: 0 to ± 1.25 to $2 \times$ nominal current
- analogue nominal output current: 50 mA to 1 A
- test voltage: 5-12 kV rms./50 Hz/1 min.
- construction: built into an insulated self-extinguishing plastic case or into an aluminium frame with insulated self-extinguishing plastic flanges.



Typical applications:

Electric traction (trains, subways, tramways, trolleys), sub-stations.

- *Series LH: These types of sensors are used for accurate measurement of currents in a magnetically disturbed environment (patented system).
- **Series L ...T: with primary bar.

LEM Modules to measure currents from 15 kA to 100 kA

Series: K.

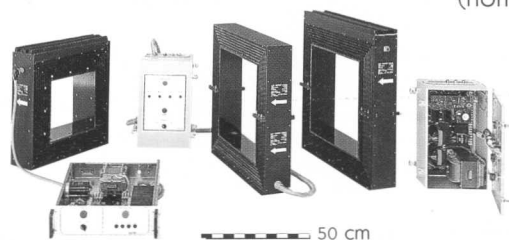
Types available in the series: KR..., KC..., KS...

General information:

- power supply voltage: 220 V/50-60 Hz ($\pm 10\%$)
- measuring range: 0 to $\pm 1.2 \times$ nominal current
- analogue nominal output current: 1/10.000 of the current to be measured
- test voltage: 6 kV rms/50 Hz/1 min.
- construction (measuring head): built into an aluminium casing which can be divided into two parts to simplify assembly at application point.

Typical applications:

Electric ovens, electrolysis, plasma generators, galvanoplasty. Research.



plasty. Research.

- KR: laboratory type, with power supply in a 19" rack
- KC: industrial type, with power supply in a watertight IP 55 casing
- KS: industrial type for severe environments, with the power supply and electronic compensating circuits in a watertight IP 55 casing.

LEM Modules for voltage measurement:

24V to 6400V primary resistor internally connected, ready for voltage measurement

(nominal value)

5mA to 20mA primary resistor external, selected by the user for 5mA to 20mA primary current (nominal value)

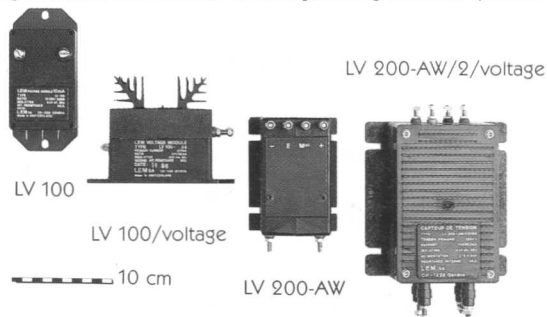
Series: LV ...

Types available in the series:

LV 50/voltage, LV 100/voltage, LV 200-AW/2/voltage*
LV 50, LV 100, LV 200-AW, LV 200-AW/2*

General information:

- power supply voltage: + and – 15 V to 24 V ($\pm 5\%$)
- measuring range: 0 to ± 1.5 to $2 \times$ nominal current (or nominal voltage)
- analogue nominal output current: 50mA to 100 mA
- test voltage: 6-12 kV rms/50 Hz/1 min.
- construction: built into an insulated self-extinguishing plastic case.



Typical applications:

Electric traction, industrial equipment.

- *Series LV 200-AW/2 and LV 200-AW/2/voltage: These sensors have 2 Hall generators. Such a system ensures improved immunity against influences of external magnetic fields.

modules

Definition — Description

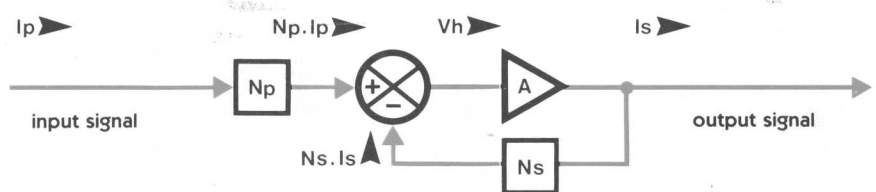
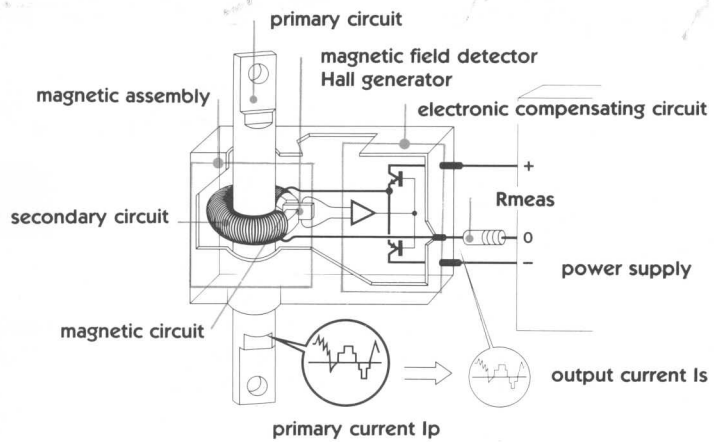
The LEM Module is a current sensor for electronic measurement of currents: AC, DC and IMPULSE, with galvanic insulation between the primary (high current) and the secondary (electronic) measurement current.

The magnetic field created by the current to be measured (primary circuit) is compensated by a field created by the secondary winding, which is equal in ampere-turns and opposite in polarity to the primary, which includes a Hall effect device, associated with a compensating electronic circuit.

Operating principle

The LEM Module is based on the principle of compensation of the magnetic field, or zero magnetic flux method (feedback system).

Principle design of the feedback system within the LEM sensor:



The magnetic field is constantly controlled at zero, the amount of nulling current required to hold zero flux is the measure of the primary current flowing, multiplied by the ratio of the secondary winding. This nulling current can be further expressed as a voltage by dropping across a resistor.

The measuring range is determined by the total of voltage drop (transistors, R_i , R_{meas}) being held to less than the voltage of the power supply driving the nulling current.

I_p : current to be measured (primary circuit)

I_s : output current (secondary circuit)

N_p : number of primary turns (=1 for current sensors, =10'000 or 20'000 for voltage sensors)

N_s : number of secondary turns

V_h : error signal produced by the Hall generator

A : amplifier gain.

The feedback is of the linear continuous type.

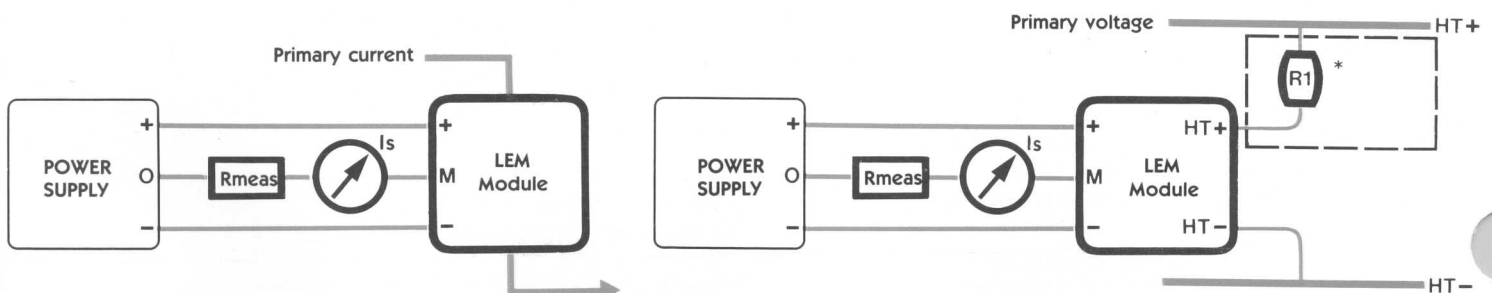
The fundamental relation is $[N_p \cdot I_p] = [N_s \cdot I_s]$

Connecting the LEM Module

– Current sensor

– Voltage sensor

*with or without incorporated primary resistor



General characteristics — Performance

- overall accuracy: 0.2% to 1% of the nominal current (according to types) including:
 - nil primary offset current;
 - drift with temperature within the operating temperature range;
 - error due to non-linearity.

Dynamic performance

- bandwidth: DC to 100 kHz, 500 kHz, according to type;
- delay time: better than 1 μ s (current sensors);
- accurately followed di/dt: better than 50 A/ μ s, and better than 500 A/ μ s according to type.

Main advantages

- Measurement of AC, DC, IMPULSE CURRENTS.
- High level of galvanic isolation between primary and measuring circuits;
- Wide measuring range and high overload capability;
- High accuracy, excellent dynamic performance;
- Good sensitivity (low level);
- Proven reliability — MTBF exceeds 10^6 hrs
- Suitable for operation in a hostile environment;
- Simplicity of use;
- Easy installation (reduced dimensions and weight);
- The mounting of a LEM Module in a power circuit neither disturbs nor modifies the circuit.

Special versions

The wide range of LEM Modules (over 1.000 types) enables the user to select the model adapted to his specific needs.

For each standard model, the following variants are available to special order.

Electrical variants:

- Turn ratio
- Power supply voltage
- Unipolar measurement and power supply
- Measuring range
- Insulation voltage
- Temperature range
- Use of selected components
- Test winding
- Electrostatic screen.

Mechanical variants

- connections (studs, connectors, fastons etc.)
- Dimensions
- Method of mounting
- Dimensions of the through-hole or the primary bar (current sensors).

LEM S.A.

First Class products and service

The various types of LEM Modules shown in this folder are standard models, but our product range is not limited to these. Many LEM Modules are manufactured in our factory to the specific needs of our customers. We suggest you contact us when designing new equipment or systems to enable us to give advice regarding the appropriate LEM Module to use.

Our long experience in the design and manufacture of LEM Modules, and our stringent quality control of the materials used, enable us to offer our customers a superior product and service.

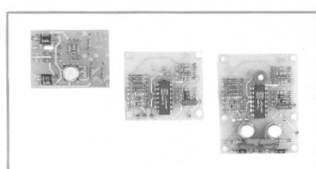
The ever increasing use of our range, guarantees that LEM Modules meet your technical requirements, in particular, in the field of power electronics.

For further information, please request our detailed literature.

Other LEM products

Peripheral equipment for LEM Modules

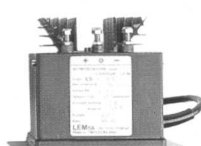
Stabilized power supplies, converters (output circuit: 4–20 mA, 0–10 V etc...) offset compensation.



LS 0.2/220-S/15



LS 0.5/220-S/24



LS 1/220-S/24

10 cm

10 cm

Non-inductive coaxial shunts for measurement of currents from 10 A to 250 A (nominal value)

Types: LEM 10*/5**... LEM 250/1

General information:

- resistance: 0.5 mOhm to 12.5 mOhm
- overall accuracy: 0.5% (+10°C to +50°C, including the variations caused by the shunt's own heat)
- bandwidth: DC to 1 MHz up to 20 MHz according to the models.
- BNC output.

*Value of permanent nominal current rms in A rms;

**Value of resistance in mOhm.



LEM 50/2

LEM 75/1

LEM 250/0.5

LEM 250/1

10 cm

LEM test equipment for power semiconductors

LEM S.A. is also NUMBER ONE in designing and manufacturing TEST EQUIPMENT for the measurement and control of dynamic and static characteristics of POWER SEMICONDUCTOR from room temperature up to 200 °C:

Diodes, GTOs, Transistors (NPN, PNP, Darlington, MOSFET channel N and channel P, IGBT).

Power semiconductor TEST SERVICE (Please call us for more information).

For more information, please request our detailed literature.



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